

border of her stomach has gradually come up from the upper border of the symphysis pubis to practically the normal position. This result may be expected in a large majority of cases of gastrectasis, provided a suitable line of treatment is carried out in addition to the duodenal feeding.

The cases cited above are merely to illustrate what may be accomplished with duodenal alimentation.

TUBERCULOSIS OF THE BRONCHIAL GLANDS AND LUNG HILUS: A CLINICAL AND RADIOGRAPHIC STUDY.¹

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FREQUENCY OF THE CONDITION. By whatsoever route tubercle bacilli enter the body, be it through the alveolar wall, the bronchial mucous membrane, or by way of the gastro-intestinal tract, they ultimately reach the bronchial glands in the great majority of instances.

In a series of 569 cases of tuberculosis, Comby² found the bronchial glands involved in all, and Hamburger and Sluka observed a like condition in 110 cases. Haushalter and Fruhinsholz³ found the bronchial glands tuberculous in 74 out of 78 infants dying of acute tuberculosis, or tuberculous meningitis.

As commonly used, the term bronchial glands includes the glands at the sides of the trachea and the group just below its bifurcation, as well as the glands surrounding the bronchi.

The largest ones are usually found below the right bronchus. The tracheal group are in relation to the superior vena cava and the vagus and recurrent laryngeal nerves. Owing to the lower origin of the left recurrent nerve, it is in contact with the trachea for a longer distance than the right one, and more often shows the effect of pressure by paralysis of the left vocal cord. When the glands attain a large size, they may press upon the arch of the aorta and its branches, the innominate veins, and the phrenic nerves.

The pericardium is anterior to the infratracheal group, and the

¹ Read before the Hartford Medical Society, June 15, 1914.

² Quoted by Grenet, *Anal. d. Méd. et Chirg. Infant*, Paris, 1911, xv, 497.

³ *Archiv. d. Méd. d. Enfant*, 1902; quoted by Grenet, *op. cit.*

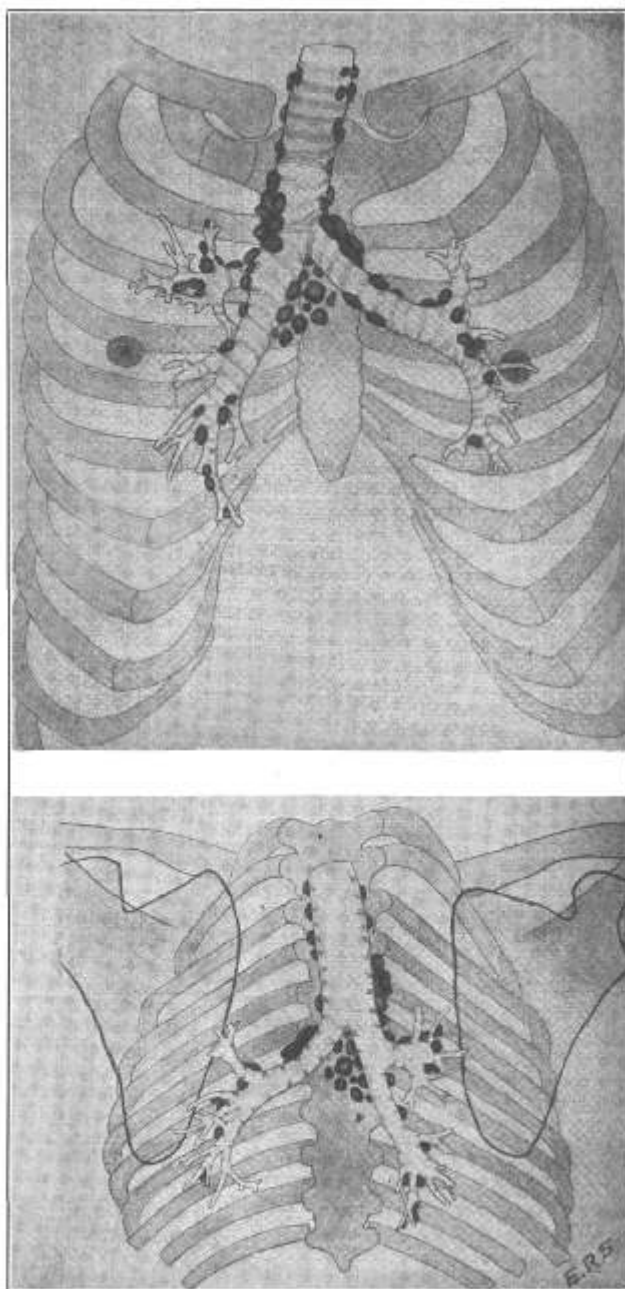


FIG. 1.—Composite drawings showing the relationship of the bronchial glands to the thoracic wall in the adult. The glands are according to Sukiennikow (*Berl. klin. Woch.*, 1903, xi, 316, 347, 369) and the trachea and bronchi are after Blake (*AMER. JOUR. MED. SCI.*, 1899, cxvii, 320). In the child the trachea bifurcates at about the level of the intervertebral disk between the fourth and fifth thoracic vertebrae, which corresponds nearly to the tip of the fourth thoracic spine. This is about opposite the articulation of the third costal cartilage anteriorly.

esophagus is behind and slightly to the left. The vagus nerve is also in relation to this group. The hilus glands are in contact with the lung and the bronchial and pulmonary vessels. The location of the several groups is shown in Fig. 1.

Leroux⁴ has stated that the glandular lesion is usually unilateral from the second to the fifth year, but that after that period it is more apt to be bilateral. Harbitz⁵ found the oldest lesion more often in either the hilus, infratracheal and peritracheal groups than in the bronchial glands proper. Up to the fifteenth year the glandular form of tuberculosis predominates, but after that age the pulmonary form is more common.

Just how the infection of the lung is brought about we do not know, though much experimental work has been done. The belief has been quite general that the bacilli after penetrating the alveolar wall or bronchial mucous membrane are promptly borne by the lymphatics to the bronchial glands. Here they may remain until the lymphatics, becoming obstructed and dilated, reverse their flow and the tuberculous lymph backs up into the lung. As early as 1876 Parrot⁶ opposed this theory. He stated that he was always able to find a lesion in the lung that was older than the glandular one, though a diligent search might be required to discover it, as it was not infrequently very small. So constant were his results that he taught his pupils that the bronchial glands were "the mirrors of the lungs."

Others have since confirmed his results, and Ghon⁷ has reported finding a primary lung lesion in 92 per cent. of 184 cases. The lesion was frequently small and often single. Ghon considers the latter fact good evidence against the theory of infection from a reversal of the lymph current. Inasmuch as it is commonly taught to search the apices for the earliest sign of tuberculous disease it is especially noteworthy that the primary focus was more often found in the lower lobe than in the upper.

Shika⁸ has recently stated that in six years of x-ray work, devoted wholly to children, he found only three cases of apical tuberculosis.

Harbitz,⁹ studying the modes of dissemination of tuberculosis in children, found that the lungs were commonly infected through the rupture of a caseous gland into a bronchus, usually near the hilus. This resulted in a caseous bronchopneumonia in the distribution of this bronchus.

By the use of the x-rays, Sluka¹⁰ found that the hilus of the lung,

⁴ Archiv. d. Méd. d. Enfant, 1908; quoted by Grenet, op. cit.

⁵ Jour. Infect. Dis., 1905, ii, 143.

⁶ Mémoires d. l. Soc. de Biol., 1876, p. 308.

⁷ Der primäre Lungenherd bei der Tuberkulose der Kinder, Berlin, 1912 (Ed. Jour. Amer. Med. Assoc., 1912, lix, 1544).

⁸ Wien klin. Woch., 1914, xxvii, 173. Abs. AMER. JOUR. MED. SCI., 1914, cxlvii, 770.

⁹ Loc. cit.

¹⁰ Wien. klin. Woch., 1910, xxiii, 156.

as well as the glands, was always involved in young infants, and frequently in older children as well.

SYMPTOMS. We do not know how long after infection takes place before symptoms and physical signs develop. Straub¹¹ is of the opinion that the primary lung focus is not accompanied by symptoms, and that they do not appear until the bronchial glands and adjacent lung becomes involved. Usually the onset is insidious, and the symptoms, which are those of a toxemia, are suggestive rather than conclusive, but their vagueness should awaken our suspicion. They often start from childhood, frequently developing after whooping cough or measles. A sense of weariness is usually present, and if the patient be a child, inquiry will show that he does not romp and play with the other children, but listlessly "sits around." The appetite is usually capricious, and the child is often irritable. Sometimes complaint is made of a sharp pain within the chest, which may radiate to the shoulder. Again, an interscapular backache may be almost constant. Vague digestive disturbances may predominate the scene, suggesting a mild form of muscular insufficiency. Phillippi¹² found hyperchlorhydria rather common. Persistence of these symptoms in a young adult who is below weight calls for investigation of the lung hilus region, as the apical signs may be equivocal or absent. The temperature is often subnormal, especially in the morning, though an afternoon rise is usually present. Occasionally the cheek on the side of the lesion will flush with every little excitement; rarely are the pupils unequal.

Often, perhaps usually, the patient has a cough; when brassy and "explosive" in quality it is extremely suggestive of bronchial adenopathy. These children "catch cold" easily, and with each cold the already swollen lymph nodes become somewhat larger, and pressing on the vagus a cough develops. The cough not infrequently causes gagging, and sometimes even vomiting occurs. But it should be much more generally appreciated that cough may be insignificant, and even entirely absent, as it was in the child whose radiograph is here shown (Fig. 7). Night sweats seem to be the exception, rather than the rule.

It has been found that infants with tuberculosis of the bronchial glands are prone to attacks of dyspnea, in which the stridor is chiefly or wholly expiratory in character, thus differing from thymic asthma, in which the dyspnea is inspiratory. As the disease progresses, the dyspnea affects both inspiration and expiration. In a number of instances the condition has been mistaken for one of laryngeal diphtheria, and intubation has been performed, but without relief. The persistence of the voice in bronchial aden-

¹¹ *Beit. z. Klinik. d. Tuberk.*, 1912, xxiv, 283.

¹² *Ibid.*, 1911, xxi, 67.

opathy and its absence in diphtheria should make this mistake infrequent.

In Guisez's case,¹³ where the dyspnea was mechanical from glandular pressure, passage of the bronchoscope brought instant relief.

Very alarming symptoms may arise from the rupture of a caseous gland into the trachea or a bronchus. The child in apparently good health is suddenly seized with extreme dyspnea and death may occur before assistance can be obtained. Goodman¹⁴ has recently collected from the literature a number of such cases. Some years ago Hall¹⁵ reported the recovery of a patient after coughing up a caseous gland which had ruptured into his bronchus. Perforation of the esophagus has also occurred, and death has immediately followed the erosion of one of the large bloodvessels (Fisher,¹⁶ Barry¹⁷).

There is nothing more puzzling to the physician than the patient who spits blood, but has no sign of a pulmonary lesion. It is probable that in some cases the blood comes from the rupture of a vessel in the mucous membrane of a bronchus overlying a tubercle, possibly the primary focus. In other cases, coughing causes a rupture of a bloodvessel already distended from the pressure of enlarged bronchial glands (Griffin,¹⁸ Barthez and Rilliet¹⁹).

A few years ago we had as a patient a boy who had a number of profuse hemorrhages. Repeated examination disclosed only signs of bronchial adenopathy—increased whisper interscapularly (D'Espine sign). We have recently been informed that he has developed well-marked signs of pulmonary involvement.

PHYSICAL SIGNS. *Inspection.* While peribronchial tuberculosis can often be recognized in the adult, it is more common in children, and the signs are usually more marked in early life. The child is usually, but not always, frail. Some years ago, one of us (Stoll) found, by means of the von Pirquet tuberculin test, that the delicate child was about four times as apt to be tuberculous as his more robust playmate.

Dilated veins interweaving across the chest usually indicate glandular pressure, though in one case where they were particularly marked, both physical signs and the x-rays were negative. Expansion may be diminished at one apex, which will be seen to "lag" with inspiration. If the breath be held at the end of inspiration and one observes the hilus region (anteriorly comprising that part of the upper two interspaces between the midclavicular and parasternal lines), an apparent retraction will frequently be noted

¹³ Bull. Soc. d. Pediat. de Paris, 1911, No. 3, p. 114.

¹⁴ Jour. Amer. Med. Assoc., 1913, lxi, 1442.

¹⁵ AMER. JOUR. MED. SCI., 1899, cxvii, 185.

¹⁶ Lancet, London, 1909, i, 28.

¹⁷ Med. News, 1885, xlvii, 236.

¹⁸ Med. Rec., New York, 1891, xxxix, 166.

¹⁹ Quoted by Coley, A Practical Treatise on the Diseases of Children, 1846, p. 185.

on one or both sides (Figs. 2, 3, 4, and 5). Usually this is only a simulated retraction, and is occasioned by the failure of this particular part of the chest to expand. This "dimpling" of the hilus region with inspiration is best seen when the patient is seated in a slanting light from a side window. The patient should be turned from side to side, as an oblique light brings out the depression best. The maximum depression is usually in the second interspace. In patients with hilus disease of long standing, when cicatrization has taken place, a well-marked depression is constantly present. Only rarely have we found the sternomastoid muscle of the affected side in spasm. In a few instances the intercostal

FIG. 2



FIG. 2.—R. P., aged fourteen years. Bilateral hilus disease of several years' duration. Aortic second accentuated and "cog-wheel" breathing, with harsh inspiration over left hilus. Posteriorly slight paravertebral dulness and d'Espine's to the fifth thoracic spine.

FIG. 3

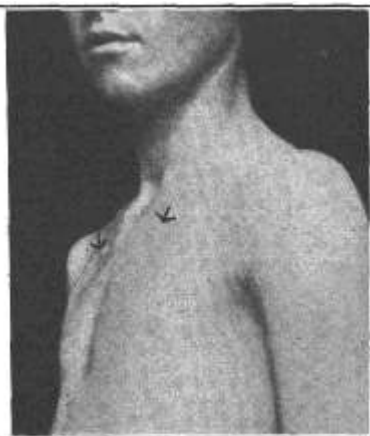


FIG. 3.—R. H., aged fourteen years. Bilateral "hilus dimple" and whispered voice over the sternum to the fourth cartilage. Bilateral paravertebral dulness and very marked d'Espine's to eighth thoracic spine. The x-ray picture shows a "well-marked shadow to the right of the vertebral column, above the cardiac shadow (paratracheal glands).

muscles over the hilus region showed some rigidity, but we have not been able to feel the confidence in this sign that Pottinger²⁰ does. Noegrath²¹ was able to demonstrate Head's zones—areas of superficial tenderness—in the majority of the children examined who were suspected of having tuberculosis. The areas involved were those supplied by the second, third, and fourth thoracic and the fourth cervical, which suggests disease of the base of the lungs and the bronchial glands.

²⁰ Jour. Amer. Med. Assoc., 1909, lii, 771; also AMER. JOUR. MED. SCI., 1909, cxxxvii, 669.

²¹ Jahrb. f. Kinder., 1911, xxiv, 74; reviewed by Michael, Amer. Jour. Dis. Child., 1912, iii, 186

Firm pressure over the sternoclavicular articulation and over the midthoracic vertebral spines may elicit pain. This is only present when the disease is active.

FIG. 4



FIG. 4.—H. B., aged fourteen years. Dilated veins, slight dulness, and bilateral "hilus dimple." Rales . . . Posteriorly, whispered bronchophony heard throughout the interscapular space. For the X-ray findings see Fig. 8.

FIG. 5



FIG. 5.—L. H., aged fifteen years. Bilateral "hilus dimple" and slight retraction below right clavicle. Inspiration cog-wheel and in the first two spaces on the left very harsh. The intercostal muscles overlying were in slight spasm, as was the sternomastoid of that side. Aortic second was accentuated and the whispered voice was present over the whole of the sternum and throughout the interscapular space. For x-ray see Fig. 10. Her history as given by her mother is quite typical. "Never robust; always 'ailing'; subject to colds with cough; often sore throats; strength and appetite poor. Is irritable and indisposed to play. Recently pain across the chest."

Percussion. Percussion, if sufficiently delicate, is a valuable diagnostic measure, but as usually performed so much normal lung is set into vibration that the dull note from the diseased focus is completely lost. In a former paper²² this is discussed at length. Both a light and very light stroke should be employed, the latter being only a tapping with the middle finger of the right

hand upon one of the terminal phalanges of the left hand, which is held firmly against the chest. It is as important that the finger be held firmly against the chest wall as it is that the blow should be a light one. Ewart²³ has happily referred to this very light percussion as "the percussion of the deaf," which means that the "feel" is as significant, perhaps, as the note obtained.

Dulness from the bronchial glands is sometimes met with anteriorly in the upper two interspaces in the parasternal line, more often on the right side. One should be familiar, however, with the slight degree of dulness normally present in the first interspace to the right of the sternum. A dull note over the sternum is rarely due to enlarged bronchial glands, but may be caused by enlargement of the glands of the anterior mediastinum. In children it is usually caused by an enlarged thymus, and, as a rule, extends to the left in the first interspace for a centimeter or more.

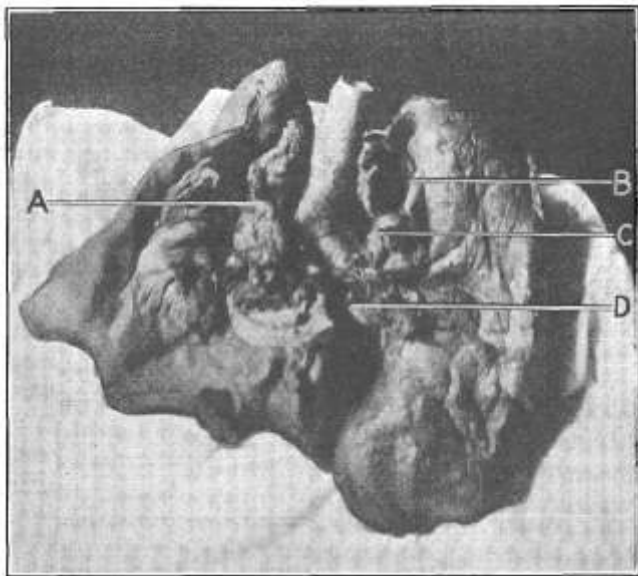


FIG. 6.—Enlarged bronchial glands in the case of H., who had had a marked d'Espine's sign for several years. An anterior view, the heart having been removed. A, large group of glands to the right of the trachea and above the right bronchus; B, cross-section of aortic arch; enlarged glands; C, above left bronchus; D, under left bronchus. The infratracheal group not enlarged.

Percussion posteriorly is usually more valuable than anteriorly. Ewart, long a champion of percussion of the spinous processes, has recently become an advocate of paravertebral percussion, which Kramer,²⁴ Nagel,²⁵ and others consider much superior to percussion of the spinous process.

²³ Prog. Med., 1913, xv, 68.

²⁵ Jahrb. f. Kinderheilk., 1908, 68, 46.

²⁴ Beit. z. klin. d. Tuberk., 1909, xiv, 335.

The relation of the hilus to the posterior chest wall is shown in Fig. 1. It is somewhat higher in children than in adults. Bing²⁶ has described a normal hilus dulness of limited extent, which is more pronounced on the right. More recently, Ewart²⁷ has drawn attention to the fact that the area of normal hilus dulness changes with respiration, being wider with expiration and narrowing at the end of the full inspiration. A "suppression of the inspiratory oscillation" on one side he considers indicative of a pathological process of that side.

As the outer border of dulness is usually the most difficult to determine, it seems to be of more practical value to observe the differences in the note at the sides of the vertebræ at the extremes of the respiratory act rather than to depend upon the differences in size of the dull area, though this is sometimes evident. As a rule, we have not been able to feel sure of the "normal hilus dulness" in healthy children, when percussing during quiet respiration.

It does not seem that very slight dulness in this region is sufficient evidence of enlarged bronchial glands, unless accompanied by other signs. Nor does the absence of dulness exclude glandular enlargement. For posterior percussion, a patient should be seated on a stool, with arms well crossed over the chest. The head is slightly inclined forward, and the upper and inner border of the lungs is outlined by König's method. The normal curve of the inner border reaches the vertebral column between the second and third thoracic vertebræ. With enlarged tracheal glands this border is often displaced outward. A dermatographic pencil is used, and one should verify his findings with closed eyes. Dulness is most commonly met with at the sides of the fourth and fifth thoracic vertebra, and more often on the right than on the left. It seems probable that the glands are not alone concerned in this dulness. The engorgement of the bloodvessels and lymphatics, which exists in the hilus region during the acute stage, is in all probability an important factor. The unsuccessful attempt to locate a golf ball in a loaf of bread by percussion strengthens this opinion. The increase of dulness noted at the end of expiration is in part due to the diminution in the air content of the lung and also to the increased congestion which Sewall and Childs²⁸ have shown attends that period of respiration. Direct percussion of the vertebral spines has not proved as satisfactory as paravertebral percussion. With a large mediastinal tumor a dull note may be obtained over the fifth and sixth thoracic spines.

Auscultation. Grancher²⁹ maintained that a diminution of the respiratory murmur was an early sign of enlarged mediastinal glands. We have met with this but twice. Once in a woman with

²⁶ Ugesk. f. Laeger, 1910, lxxii, 199.

²⁷ Loc. cit.

²⁸ Archiv. Int. Med., 1912, x, 45.

²⁹ Bull. acad. de Méd., 1906, lxx, No. 36; abstract Jour. Amer. Med. Assoc., 1906, xlvii, 2041

advanced Hodgkin's disease, and the other time in the child whose x-ray is here shown (Fig. 7).

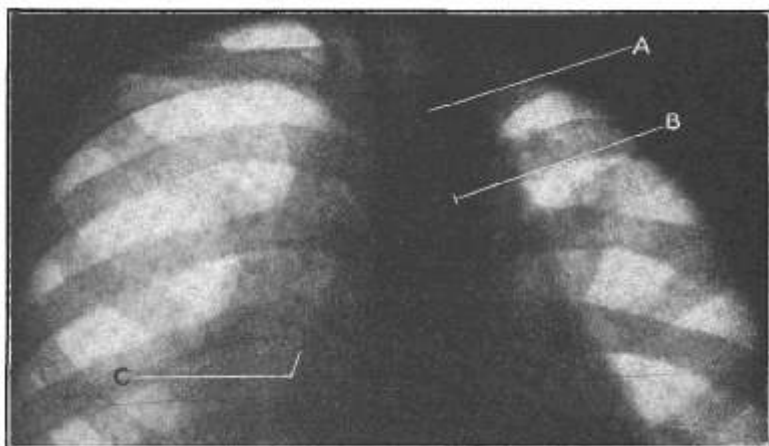


FIG. 7.—H. A., aged ten years. Referred by Dr. W. G. Murphy. There was slight dullness in the two right interspaces near the sternum. Very dull in the third space, extending to the parasternal line. Respiratory sounds much diminished over right lower lobe. A few rales in inner third first interspace and over lower lobe. Posteriorly no paravertebral dullness but d'Espine's sign, more marked on the left than on the right, was heard as low as the inferior angle of the scapula. Aortic second sound accentuated. The x-rays show extensive disease of the right hilus. The inner end of line *C* indicates the right border of the heart. The left border of the trachea is indicated by *A*. Line *B* shows the beginning of the left bronchus. Notwithstanding this extensive lesion this child had no cough. A footnote refers to the autopsy findings in this case.

A harsh inspiration, often "cog-wheel" in type, was sometimes heard over the hilus region anteriorly. The x-rays showed hilus disease of the side where this type of breathing was noted in several cases, and we are inclined to think this may be a valuable sign of hilus involvement. In one instance the x-rays showed bilateral hilus disease, and the harsh inspiration was noted only on one side. In this case there was spasm of the intercostal muscle over the area of harsh inspiration, suggesting that this was the more active lesion. In one patient the breathing was quite bronchial near the spine of the left scapula.

In a considerable number of children with signs of enlarged bronchial glands, one may detect fine crepitations in the vicinity of the nipple. They may be apparent only on coughing, and are not to be confused with atelectatic rales, which disappear after one or two deep breaths. Miller and Woodruff³⁰ found that the children with these rales gave a much higher percentage of positive reaction to tuberculin than other children.

³⁰ Jour. Amer. Med. Assoc., 1909, lli, 1016.

Several times an accentuation of the aortic second sound has been noted, and in one such case coming to autopsy there was a group of enlarged glands between the aorta and the chest wall.

Of particular importance is the character and distribution of the voice and especially the whispered voice. In the normal individual if the stethoscope be pressed firmly against the chest wall, the area of transmission of the whispered voice is slight. Anteriorly it is normally heard throughout the first right interspace, and in the inner half of the left, and posteriorly it is not present below the seventh cervical spine in children and the fourth thoracic in adults.

There is a peculiar quality to the whispered voice that is of the greatest significance. It consists in a continuation of the sound for a moment after phonation has ceased. It is best brought out by having the patient whisper "three thirty-three" (children can usually say "tree, tree, tree" more easily), when it will be observed that the final "e" of the last word "three" has an echoing quality and persists a moment after speech has ceased. This postphonal element alone is significant. For many years, D'Espine³¹ has diagnosed enlargement of the bronchial glands by this sign alone. He observed that in children the tracheal quality of the whispered voice did not normally extend below the seventh cervical spine. When heard over the upper thoracic vertebræ, he considered it indicative of bronchial adenopathy. It is usually heard for a variable distance at one or both sides of the vertebræ, and to be of significance in adults it should extend at least as low as the fifth thoracic. The diagnostic import increases with the area of distribution.

Sewall³² attributes the whispered bronchophony to congestion of the lung parenchyma, and he considers it the earliest evidence of tuberculous infiltration. In a few of our cases, where stereoradiographs were taken, the fine lines were seen to extend to the surface of the lung in the interscapular region, which would seem to support Sewall's theory. From the result of the autopsy findings in four of our cases, however, we are inclined to think that the glands lying along the trachea and bronchi play a large part in the transmission of the tracheal quality to the whispered voice.

The intensity of the bronchophony, moreover, is usually much increased by flexing the head well forward, which carries the trachea and bronchi with their glands backward toward the vertebral column.

This sign was well marked in three out of four adults in the Hartford Hospital, with aneurysm of the aortic arch, presumably from pressure on the left bronchus. Both Zabel³³ and Koch³⁴ have

³¹ Bull. Acad. de Méd., 1907, lvii, 167.

³² Loc. cit.

³³ Münch. med. Woch., 1912, lix, No. 49; Jour. Amer. Med. Assoc., Abs. 1913, ix, 250.

³⁴ Tribune Med., 1912, viii, 381; quoted by Da Costa, AMER. JOUR. MED. SCI., 1913, cxlvi, 660.

observed it in cancer of the esophagus, though whether from metastasis in the bronchial glands or direct pressure on the bronchus was not known.

Increased whisper is much less common anteriorly, though it is occasionally heard over a considerable part of the sternum or along its border. It is sometimes present in the anterior axillary line just under the lower border of the pectoralis major muscle.

Several children in whom D'Espine's sign was present a few years ago, have improved much in health since coming under observation, and both the intensity of the whisper and its area of distribution are notably less.

Not only should one observe the quality of the voice, but auscultation should be performed when the patient coughs, for occasionally one will observe an echoing quality to the cough, even in the absence of whispered bronchophony.

D'Espine has had several autopsy confirmations of the value of whispered bronchophony in diagnosing enlarged bronchial glands. In a previous paper (Stoll³⁵), drawing attention to the value of whispered bronchophony in the diagnosis of tuberculosis in the aged, mention was made of finding enlarged glands in two adults who had had this sign. A third case has since come to autopsy. The complete history has been given elsewhere. The important points are as follows: Mrs. A. H., aged sixty-four years, had hemorrhage and cough "off and on" for many years, and with each attack she would "run down." The most noteworthy sign was the large area between the scapulæ over which D'Espine's sign was present. She died last winter, after a few days' illness, of a double pneumonia. The bronchial glands, especially the tracheal group, were much enlarged, as the accompanying photograph (Fig. 6) shows. No giant cells were found in either of two sections which Dr. J. C. Rowley kindly examined for me, though there was much pigmentation.

In only one case have we been able to compare the x-ray findings with a postmortem examination.³⁶ Louis G, aged two years, was admitted to the service of Dr. Charles Goodrich at the Hartford Hospital, May 28, 1912, because of enormously swollen cervical glands. Through Dr. Goodrich's courtesy the child was examined several times. There was dullness over the sternum and in the first three left interspaces as far out as the midclavicular line. Posteriorly well-defined dullness to below the spine of the scapula, extending $1\frac{1}{2}$ inches to the right of the spinal column and 1 inch to the left. The breath sounds were somewhat diminished and slightly tubular in quality. At the first examination the cry was

³⁵ Boston Med. and Surg. Jour., 1912, clxvii, 291.

³⁶ Since this article was written another case has come to autopsy. The x-ray being Fig. 7. There was advanced disease throughout right lung with large tuberculous bronchial glands. This will be reported later with photographs.

thought to be indicative of enlarged glands, but a note was made a few days later that there were "no auscultatory signs of enlargement of the bronchial glands." Yet, nevertheless, we felt that the glands were enlarged. Two months later, during which time the child had steadily failed, the dulnesses mentioned before had diminished very much, and a few scattered rales and small areas of bronchovesicular breathing had developed. The cervical glands diminished markedly in size during the last weeks of illness.

The *x*-rays showed the fine markings were very much increased, and extended to the periphery of the lung. Along the course of these interweaving thread-like lines were small dot-like shadows, giving the appearance of knots tied in thread. The largest of these were about the size of a pinhead. There was considerable increase in the shadow above the heart at the right root, which was incorrectly attributed to bronchial glands. As the picture was taken while the child was crying very hard and holding its breath, the shadow was probably a distended superior vena cava. In a second *x*-ray, taken just after death, this shadow was very much less.

The autopsy revealed no enlargement of the bronchial glands. The mediastinum was somewhat congested, and a few small tubercles were scattered throughout the lungs. A small group, the largest being pinhead in size, was found just under the pleura of the left upper lobe, and was apparently shown in the *x*-ray. The mesenteric glands were much enlarged and several were broken down.

It seems probable that the dulness noted anteriorly when the child first came under observation was due to an enlarged thymus, which decreased in size during the long illness, until at death scarcely a trace remained. The diminution of the dulness toward the last of the illness favors this theory. That the *x*-rays do not show thymic enlargement may be due to its being taken with the child on its back.

The impairment of resonance to the right of the upper thoracic vertebræ may have been the result of congestion of the hilus vessels.

It is conceivable that enlarged bronchial glands might have diminished in size coincidently with the cervical group, but not that they should show no enlargement at autopsy.

The infection of the lungs was evidently hematogenous from a mesenteric or cervical gland, and death occurred before the bronchial glands were involved.

The venous hum heard over the upper part of the sternum when the head is retracted does not seem to be a sign of value.

As to the value of tuberculin, we are still of the opinion, expressed elsewhere,³⁷ that "Even when the tuberculin test is positive, we have to fall back on the symptoms to ascertain whether we are

³⁷ Loc. cit.

dealing with clinical tuberculosis which needs immediate treatment, or with only an anatomical lesion which requires temperance in all things."

RADIOGRAPHY. The large central shadow observed in the normal thorax is due to the heart and mediastinal contents. Extending out laterally are the heavy shadows caused by the large or stem bronchi. On the right side both ascending and descending bronchi are distinctly seen, but on the left, due to the intervention of the cardiac shadow, the greater part of the descending bronchus is not visible. The density of these shadows increases with age, being, as a rule, much heavier in the adult. Radiating from these coarser markings are finer lines which project into the lung field for varying distances, but do not extend normally to the surface of the lung. These markings are produced by the walls of the bronchi and the blood and lymph vessels with their contents.

Dunham and Boardman³⁸ found that in early tuberculosis these fine lines often reach the periphery of the lung at the site of the lesion. While our series of stereoscopic plates is small, in a number of instances we have observed this. In the infant with early miliary tuberculosis above referred to, which came to autopsy, the most distinctive feature was the filling of both lung fields with fine interweaving lines. In other cases where these lines did not extend into the lung field for any considerable distance, they were much more numerous and heavier than normal about the hilus region. In a few instances we have seen near the root small "soft" shadows with hazy irregular borders which are well shown in the stereoscopic negatives from which Fig. 8 is made. Fine lines can be seen connecting these shadows with the lung root. This is apparently an early involvement of the lung parenchyma in the hilus region. In non-stereoscopic negatives we have observed a shadow which is in the position normally occupied by the superior vena cava. This shadow is concave to the right, while the one caused by glands is convex, and is, moreover, of greater density, and protrudes farther into the lung field. It extends from the tip of the third cartilage upward toward the clavicle, giving an increased width to the root of the lung. Since drawing attention to this shadow in 1910³⁹ a number of other observers have mentioned it as an early evidence of enlarged bronchial glands. Involvement of the parenchyma in the hilus region is usually roughly wedge-shaped with the apex at the hilus. When the disease is but slightly active the shadow borders are usually sharp. In the more acute cases the shadow is softer and the border often ill-defined (acute exudative type of Cole). Because of the interposition of the cardiac shadow the infratracheal glands are usually not seen.

³⁸ Bull. Johns Hopkins Hosp., 1911, xxii, 229.

³⁹ Proc. National Association for Study and Prevention of Tuberculosis, 1910, vi, 252; also AMER. JOUR. MED. SCI., 1911, cxli, 83.

It is impossible for one who has not studied stereoscopic negatives to appreciate their superiority over the single plate method. While a lesion may be distinctly shown by the later process its exact situation cannot be determined. It is desirable for the

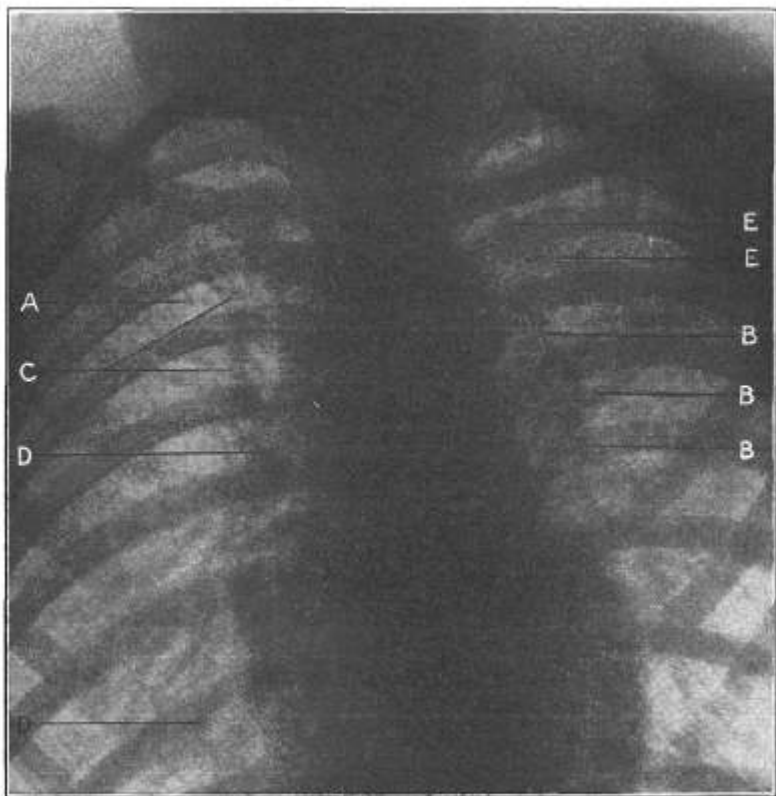


FIG. 8.—Stereoscopic appearance. (For physical signs see legend with Fig. 4.) Anterior view. The distortion of the mediastinal contents is due to the rotation of the chin to the right. In the upper lobe the fine lines approach almost to the lung surface, and in the first interspace there are two small tubercles just below the surface: A, at the left root are a number of tubercles which are arranged in three different layers resembling mountain ranges (B, B, B). In the lower part of the left upper lobe are observed several small shadows (E) of little density and with an ill-defined and irregular border. These are connected by fine lines with the root and are presumably early tuberculous foci. Posteriorly the finer markings extend to the surface of the right lung in the fifth (C), eighth, ninth, and tenth interspaces. A number of tubercles are seen at the root (D) and throughout the lower lobe.

clinician to learn to interpret his own radiographs, as only by this means can he satisfactorily compare his physical signs with the x-ray findings. All our cases were examined and the physical signs recorded before being radiographed.

TECHNIQUE. The method we find most desirable, and the one giving us the best soft-tissue detail, is as follows: With the patient in the erect position a moderately soft tube is placed approximately six feet from the plate (14 x 17 mounted in a screen). A small diaphragm is used and an exposure of one-half to one second is made. For stereoscopic work we use an automatic plate-changing device. The right oblique position has not proved very satisfactory.

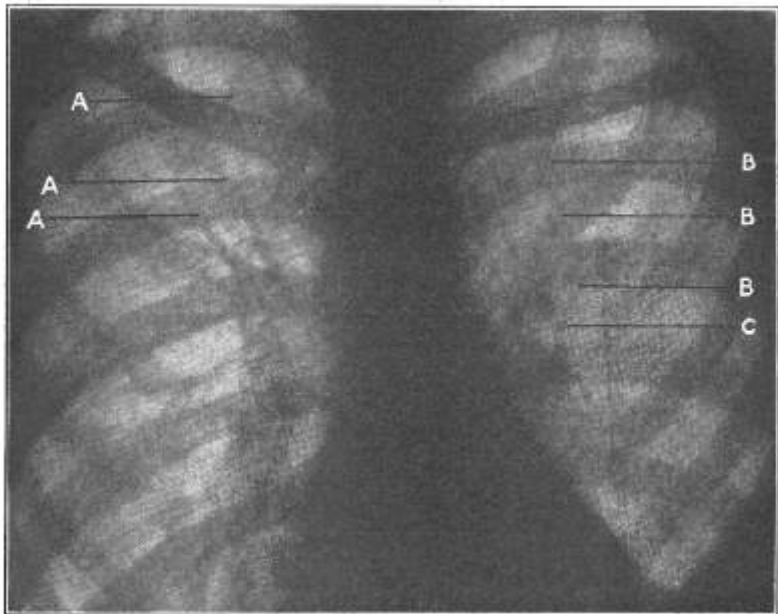


FIG. 9.—J. L., aged seven years. Eczema as infant, whooping cough when one and a half years old, and ever since has had a cough. When first examined in 1909 had small moist rales over upper two-thirds of both lungs. Well-marked d'Espine and a small area of bronchovesicular breathing at the inferior angle of left scapula. The rales have cleared up except a few at both bases, and the most marked whisper is heard just internal to inferior angle of left scapula. Stereoscopic appearance: The right descending bronchus is much heavier than normal. An increase of lines from right apex to root (A) is to be observed and a haziness of the whole of the apex. The fine lines extend to the surface of the lung in the third, fourth, fifth, and sixth (B) interspaces left and the first, second, third, and fourth interspaces of the right side when viewed from behind, but in the anterior view the line markings do not reach the surface. The fine lines at the lung root are increased. Several tubercles can be seen at C.

TREATMENT. When diagnosed early the usual out-of-doors treatment for tuberculosis will usually suffice. Children so affected should attend an open-air school, as there are few environments more disastrous to health than the usual overheated, unventilated school-room. In several instances we have given tuberculin therapeutically with seemingly good effect. One child in particular, whose cough at night was very distressing, experienced great

relief from tuberculin treatment. Interruption of the treatment was followed by a recurrence of the cough, which again became less upon the resumption of tuberculin. This sequence of events was repeated several times, as it was impossible to make the mother realize the necessity of keeping up the treatment. Dr. H. W. Brayton made a number of blood-counts before and after the

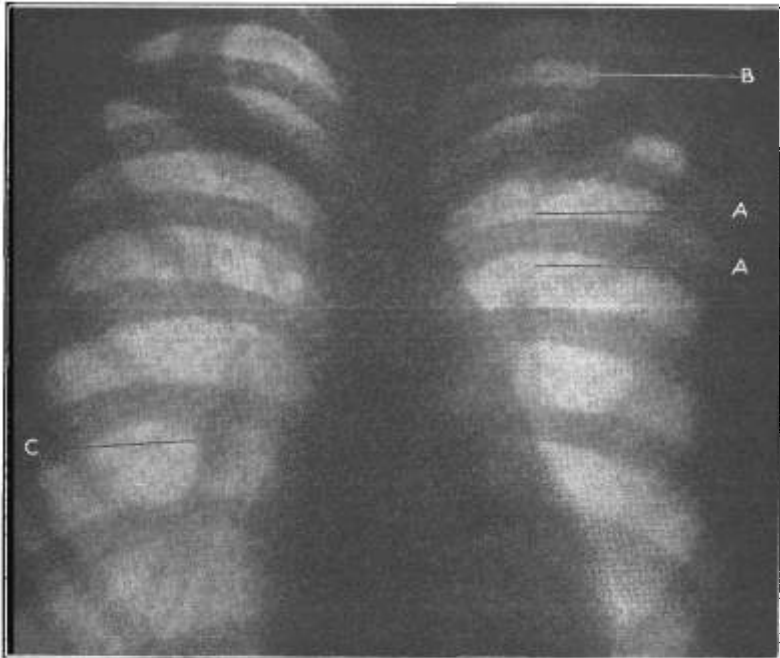


Fig. 10.—Stereoscopic appearance. L. H. (For physical signs see legend with Fig. 5.) Anterior view. The fine lines (A) extending upward from the left root to the apex are somewhat increased and slight cloudiness to the whole left apex (B) above the clavicle. At the right root, opposite the third rib, an enlarged bronchial gland (C) can be seen in which are a number of tubercles. The lines radiating from the right root, especially those standing downward, are heavier and more numerous than usual. None of the fine lines extend to the surface in the anterior view, but when examined from behind the fine lines extend to the periphery in the fifth interspace. The clinical diagnosis was "involvement of the bronchial glands and right root." The lesion at the left apex was not recognized, though it should have been because of the harsh inspiration and muscle spasm.

tuberculin injection, and did not observe that the lymphocytes were increased after the tuberculin injection, as Schulz⁴⁰ claimed they were.

When the lung adjacent to the glands is shown by means of the x-rays to be involved, Straub and Otten⁴¹ advise making an artificial pneumothorax.

The gradually increasing dyspnea is difficult to deal with. Believing that he was operating for the relief of the dyspnea from

⁴⁰ Beitr. z. klin. d. Tuberk., 1911, xxi, 79.

⁴¹ Loc. cit.

an enlarged thymus, Veau⁴² exposed a mass of caseous bronchial glands, which he removed. Betke⁴³ also operated successfully on a woman, aged twenty-nine years, who had tracheal stenosis from tuberculous glands at the bifurcation of the trachea.

It is possible that with the more general adoption of one of the methods by which the thoracic cavity can be explored with impunity, operative relief in these cases will become the rule.

Such excellent results have been obtained in thymic dyspnea by x-ray treatment, that it seems it should be thoroughly tested in enlarged bronchial glands.

Mention has been made of the relief of the dyspnea from the passage of the bronchoscope. This can only take place when the dyspnea is due to actual pressure of a gland on the trachea, and it is a procedure of much hazard, for if the instrument should perforate the already bulging and diseased tracheal wall the result would probably be disastrous. As the dyspnea in most cases is the result of a vagus neuritis rather than a mechanical pressure, it would seem that the usefulness of the bronchoscope in these cases is not great.

The urgent dyspnea from the rupture of a gland into a bronchus or trachea calls for immediate relief. If the patient is not able to expel the disintegrated gland by coughing, a tracheotomy should be performed and a large catheter, with the end cut off, so that the opening is at the end, passed downward. In the cases where the obstruction is due to pus, aspiration might be life-saving. In Goodman's case, insufflation caused the pus to be discharged through the tracheotomy wound by the sides of the tube.

CONCLUSIONS. 1. Prior to the fifteenth year, tuberculosis of the bronchial glands and lung hilus is the most common form of tuberculous disease.

2. The early symptoms are usually indefinite and chiefly of toxic origin. While a cough is generally present, it may be entirely absent even with advanced disease of the bronchial glands.

3. Although the orthodox signs of incipient (apical) tuberculosis are not present in these cases—in fact, the primary lesion is often in the lower lobe—there are certain physical signs which are indicative of a pathological process at the lung root.

4. The significant signs are a "hilus dimple" (noted anteriorly over the hilus region at the end of inspiration), dilated veins, parasternal and paravertebral dullness, and most significant of all, a well-marked whispered bronchophony in the interscapular region (d'Espine's sign).

5. Radiography, and especially stereoradiography, is of the utmost value in these cases, as it shows the exact location and extent of the morbid process, and is the greatest stimulus to careful clinical work.

⁴² Bull. Soc. de pediat. de Paris, 1911, No. 2, p. 83.

⁴³ Berl. klin. Woch., 1913, No. 4, p. 197; quoted by Goodman, *op. cit.*